

Claims

1. A device of modular construction for handling workpieces (22), in particular vehicle chassis (22), said device comprising
 - a first module having
 - a handling line (12) with one or more handling regions (14) for the surface treatment of said workpieces (22); and
 - a guide device (44) along said handling line (12); and
 - a second module having one or more carriages (20; 40; 60) to which said workpieces (22) may be fixed and which may be moved along said guide device (44); wherein
 - various types of second module may each be combined with said first module.
2. A device according to claim 1, characterized in that said guide device (44) is disposed on one side of said handling line (12) only.
3. A device according to claim 2, characterized in that said guide device comprises at least one rail (44).
4. A device according to claim 3, characterized in that said carriages (20; 40; 60) have rollers (30) that roll on said at least one rail (44) of said guide device.
5. A device according to any of the preceding claims, characterized in that said first module further comprises
 - a first transfer station (18) that interacts with a first conveying means for supplying said workpieces (22) to be handled; and

- a second transfer station (18) that interacts with a second conveying means (46) for removing said handled workpieces (22).
6. A device according to claim 5,
characterized in that said first module further comprises
- a return means, preferably in the form of a conveyor belt (70) or chain conveyor, for conveying said carriages from said second transfer station (18) to said first transfer station (18).
7. A device according to claim 6,
characterized in that said return means (70) has a switching means for transferring carriages into or out of a maintenance zone.
8. A device according to any of claims 5 to 7,
characterized in that said carriages (20; 40; 60) in said second transfer station (18) are pivoted through an angle of approx. 90° around a pivoting shaft (68) in the region of said guide device (44), and said carriages in said first transfer station (18) are pivoted back through the same angle in the opposite direction.
9. A device according to claim 8,
characterized in that said pivoting shaft (68) is disposed essentially parallel to said guide device (44) and on that side of said guide device (44) which faces away from said one or more handling regions (14).
10. A device according to any of the preceding claims,
characterized in that said carriages (20; 40; 60) and said guide device (40) are designed such that during the handling of said workpieces (22), all the bearings are at any time disposed outside said one or more handling regions (14).
11. A device according to any of the preceding claims,
characterized in that said carriages (20; 40; 60) comprise
- an outer frame (26); and

- an inner frame (28) that revolves around a rotary shaft (32) relative to said outer frame, whereby said workpieces (22) may be fixed to said inner frame (28); wherein
 - said rotary shaft (32) of each carriage is disposed in an essentially horizontal and perpendicular manner in relation to the direction of movement of said carriages (20; 40; 60) along said handling line (12).
12. A device according to claim 12, further comprising
- a means for lifting and/or inclining said rotary shaft (32) relative to said outer frame.
13. A device according to claim 11 or claim 12, so far as they refer back to claim 5, characterized in that said carriages (20; 40) may be coupled together in the region of said first transfer station (18) and may be detached from one another in the region of said second transfer station (18).
14. A device according to claim 13, characterized in that said outer frames (26) have front coupling members (50a) and rear coupling members (50b) that are designed such that said rear coupling member (50b) of each carriage (20; 40) may form a detachable form-locked connection with said front coupling member (50a) of a following carriage (20; 40).
15. A device according to claim 13 or claim 14, characterized in that said carriages (20; 40) have a connecting means, preferably a hook-shaped projection, disposed in the region of said outer frame, for a pulling means (52).
16. A device according to claim 15, characterized in that said pulling means (52) is disposed in the region of said second transfer station (18) or a pushing means is disposed in the region of said first transfer station, said means being designed to form a detachable connection with said connecting means (36) of that carriage (20; 40) which is located nearest to said second transfer station (18) in the region of said handling line (12), whereby said carriage may be forcibly guided by said pulling means (52) toward said second transfer station (18) or the plurality of carriages that are coupled

together may be forcibly guided by said pushing means in the direction of said second transfer station.

17. A device according to any of claims 11 to 16,
characterized in that said second module further comprises
 - a control means (48; 48a; 48b) in the region of said guide device (44) that interacts with said carriages (20) such as to control a relative rotational movement between an outer frame (26) and an inner frame (28) around said rotary shaft (32).
18. A device according to claim 17,
characterized in that said control means comprises a guide rail (48) having inclined guide portions (48a, 48b), said guide rail interacting with a lever assembly (38) connected in a rotationally rigid manner to said inner frame (28).
19. A device according to any of claims 11 to 16, further comprising a rotary drive (42) on each carriage, said rotary drive being connected at the output side in a rotationally rigid manner to said inner frame (28) of said carriages (40; 60).
20. A device according to claim 11 or claim 12,
characterized in that said carriages (60) comprise
 - a travel drive (64) for the translatory movement of said carriages (60) along said handling line (12); and
 - a rotary drive (42) for the rotational movement of said inner frame (28) relative to said outer frame (26);
 - the translatory movement being independent of the rotational movement.

21. A device according to claim 19 or claim 20, characterized in that the transfer of information and/or power from said first module to said carriages is effected contactlessly, particularly inductively.
22. A method for handling workpieces, in particular vehicle chassis, in a device having a handling line with one or more handling regions for the surface treatment of said workpieces, wherein said workpieces are fixed to carriages that are moved along said handling line, said method comprising the steps of
- initially transporting a workpiece by way of a first conveying means to a first transfer station;
 - pivoting a carriage up around a pivoting shaft until said carriage holds said workpiece;
 - passing through said handling line as far as a second transfer station while performing an additional, sectional rotational movement for introducing said workpiece into, or removing it from, one or more handling regions;
 - pivoting said carriage down around said pivoting shaft in the region of said second transfer station; and at the same time
 - removing said workpiece by way of a second conveying means;
 - transporting said carriages that have been pivoted through approx. 90° out of the horizontal plane back to said first transfer station.
23. A method according to claim 22, characterized in that said carriages in said second transfer station are pivoted through an angle of approx. 90° around a pivoting shaft in the region of said guide device and said carriages in said first transfer station are pivoted back through the same angle in the opposite direction.
24. A method according to claim 23, characterized in that said pivoting shaft is disposed essentially parallel to said guide device and on that side of said guide device which faces away from said one or more handling regions.

25. A method according to any of claims 22 to 24, characterized in that said workpieces are vehicle chassis that are dipped into treatment baths, whereby when they are dipped into a treatment bath, said vehicle chassis are rotated through 180° around a rotary shaft disposed in an essentially horizontal and perpendicular manner in relation to the direction of movement along said handling line, said vehicle chassis pass through said treatment bath in this position and are again rotated through 180° around said rotary shaft when they are removed from said treatment bath.
26. A method according to claim 25, characterized in that said vehicle chassis additionally execute a reciprocating movement when they pass through said treatment baths.
27. A method according to claims 25 to 26, characterized in that said vehicle chassis are coupled together in the region of said handling line in that a carriage pivoted up in the region of said first transfer station is connected in a form-locked manner with the adjacent carriage located in the region of said handling line, and the form-locked connection disengages again when said adjacent carriage is pivoted down in the region of said second transfer station.
28. A method according to any of claims 22 to 27, characterized in that the transportation speed of said carriages is higher during return travel than the average speed of said carriages in the region of said handling line.
29. A device according to any of claims 22 to 28, characterized in that the rotational movement of said carriages is coupled to the translatory movement thereof.
30. A method according to any of claims 22 to 28, characterized in that the rotational movement of said carriages is independent of the translatory movement thereof.

31. A method according to claim 30, characterized in that said carriages in the region of said handling line are moved independently of one another in the translational direction.
32. A method according to any of claims 22 to 29, further comprising the production of a detachable connection between a pulling means or drive means and a connecting means of that carriage which is located nearest to said second transfer station in the region of said handling line, said carriage being pulled by said pulling means or drive means toward said second transfer station.
33. A method according to any of claims 22 to 29, further comprising the production of a connection between a pushing means and a plurality of carriages that are connected together, and the pushing of said carriages that are connected together in the direction of said second transfer station.